

# Put *Life* Into Algebra

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# Life Options

## Some Ways to Put Life Into Algebra

### 1) Traditional

Emphasis is on learning procedures and skill development. Curriculum structure is logical but not meaningful. Application and life connection problems appear secondary to the procedural purpose of the lesson. The traditional approach delays meaning to the end of the lesson, section, or chapter. The new textbooks have more and better life application problems that are most likely not assigned to students. Why?

### 2) Flip the Order

Emphasis is on establishing meaning before learning skills and procedures. Whenever possible and practical, begin with a real-life application or context to motivate a reason for learning the skill. The new textbooks and the Internet provide numerous contexts. This may be the best way for teachers to put “life” into algebra without a radical shift in the structure of an algebra course.

### 3) Restructure

Use of mathematical modeling is one example of a meaningful structure for introducing algebra concepts and skills. Begin with a real-life context, explore and develop the mathematics within the context, practice emerging skills, and extend the skills and understanding to other contexts. Some of the integrated mathematics curricula use this or a similar approach.

# **Put Life Into Algebra**

## **Session Learning Goal**

Teachers will learn how to (and choose to):

- 1) Begin with a meaningful real-life context, whenever possible, to establish the practical need for a particular algebra skill or procedure.
- 2) Practice the skills and procedures within the context and separate from the context.
- 3) Apply the skills and procedures to other contexts whenever possible.
- 4) Blend and weave conceptual development with meaning and procedures.

# *Monterey Bay Parking*

Monterey Bay is situated along the scenic California coast north of the famous Big Sur. The aquarium at Monterey, along with Cannery Row, and the Fisherman's Wharf, attracts visitors from all over the United States and the world.

The sharks, otters, octopus and jellyfish are favorites of both young and old. Put your hand into the bat ray tank and you may get to pet a ray. A separate "touch tank" gives you the opportunity to pick up and handle a star fish or a sea slug.

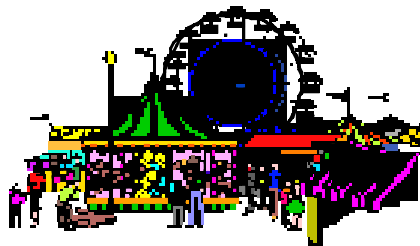
Tickets may be purchased in advance or at the door. Parking is another story. If you get there early enough you have several choices for parking. The parking meters along the local streets give you 10 minutes of time for \$0.25. The meters closest to the aquarium have a 2-hour limit with 4-hour and 12-hour meters several blocks away. The parking lot run by the city offers one free hour then charges \$1.50 per half hour with a maximum of \$18.00 no matter how long you park. Finally, a few restaurants offer parking in their lots for \$10.00 per car. You pay \$10.00 and stay as long as you want.

Which of the options described above is the best choice for parking? Use mathematics to help you decide.

You will be asked to present your answer to the class and defend your answer with clear and thorough reasons. Tables, graphs, diagrams and pictures are encouraged.

<http://www.monterey.org/parking/garages.html>

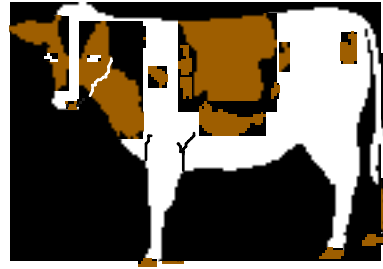
# Carnival Rides



Admission to the Lane County Fair is \$9.00. You are charged \$3.50 for each ride.

- 1) Complete a table representing sample values (at least 8 entries). Label the first column "Number of Rides." Label the second column "Total Cost."
- 2) Use the table values to prepare a graph. Graph neatly.
- 3) Make an arrow diagram to show the process for finding total cost.  
*Represent the process as a function with variables.*
- 4) You have \$50.00. How many rides can you go on?  
*What equation would you solve to answer this question?*
- 5) You have \$100.00. How many rides can you go on?
- 6) How would the graph be different if admission were \$20.00?
- 7) How would the graph be different if rides cost \$2.50?
- 8) What are the domain and the range?
- 9) You buy an unlimited-use pass for \$25.00. All rides are free with the pass. Describe the graph.
- 10) Is the unlimited-use pass a better deal? Justify your answer.

# Moovers



*Moovers* rents trucks for \$54.95. With your rental you get 75 free miles and then you are charged \$0.68 per mile for additional miles. How many miles can you travel if your moving allowance is \$600?

What equation could you solve to answer this question?

# Sunrise Hotel

Jacqueline is planning a banquet for her team. The *Sunrise Hotel* charges \$900 to rent the meeting room and \$21.50 per person for the meal. The *Highway Hotel* charges \$650 for a room and \$24.50 per person for the meal.

- a) Complete a table of sample values for each hotel.
- b) Prepare one graph to compare the costs for both hotels.
- c) Which hotel is less expensive?
- d) What is the number of people which makes total cost equal? *Provide evidence to support your conclusion.*

## ***Health Club***

**You pay \$125 to join a health club. The monthly membership fee is \$22.50.**

- 1) Complete a table representing sample values (at least 8 entries). Label the first column "Number of Months." Label the second column "Total Cost."
- 2) Make an arrow diagram to show the process for finding total cost.
- 3) Prepare a graph. Graph neatly.
- 4) A friend gives you a \$250 scholarship to join the club. How many months are covered (including the fee to join the club)?
- 5) You win a radio contest. You receive \$500 toward the health club membership and monthly fees. How many months are covered?
- 6) How would the graph be different if it cost \$75.00 to join the club?
- 7) How would the graph be different if the monthly fee is \$15.95?
- 8) Describe the domain and the range.

## ***Phone Plan***

**You pay \$35.00 per month for your phone plan. You get 90 minutes free. Additional minutes cost \$0.45 for each minute.**

- 1) Complete a table representing sample values (at least 8 entries). Label the first column "Number of Minutes." Label the second column "Total Monthly Cost." Five of the entries must be for minutes greater than 90.
- 2) Make an arrow diagram to show the process for finding total cost.
- 3) Prepare a graph. Graph neatly.
- 4) Your parents limit you to \$60.00 per month. How many minutes are you allowed?
- 5) Your monthly bill is \$83.00. How many minutes did you use the phone?
- 6) How is the graph different if the monthly fee is changed to \$40.00 ?
- 7) How is the graph different if the charge is \$0.29 per minute?
- 8) Describe the domain and the range.



## *Skate Park*

A local indoor skate park charges \$12.00 admission for a two-hour session. Members only pay \$5.00 per session. The price for membership is \$50.00 for the year.

Sample Questions:

- 1) Suppose you are not a member and you attend four sessions in one year. What is your total cost for admission?
- 2) Suppose you are a member and you attend four sessions in one year. What is your total cost for admission? (Remember to include the cost for membership.)
- 3) Should you pay for membership if you plan to attend six sessions in one year? Use mathematics to support your answer.
- 4) What is the minimum number of sessions that would make it worthwhile to pay the membership fee?
- 5) Suppose you are preparing a table of values to compare total cost with and without membership. Describe the domain and the range for the table values.
- 6) Assume you pay the fee and become members. Write a function to represent the total cost for admission based on the number of sessions. Prepare a table of values and graph the function.
- 7) Your grandparent gave you a \$200 gift card to the Skate Park to cover the cost of membership and admission to sessions. What equation do you solve to determine the number of sessions covered by the gift card?
- 8) Describe the change in the graph of the function if the membership fee is raised to \$100 for the year. Describe the change in the graph of the function if the session cost for members is raised to \$8.00 per session.

What algebra skills might be used to answer the questions? What CA Algebra Standards are addressed?

# Memories

School yearbook sales are like a business. Decisions must be made about the selling price, how many pages to include in the book and how many yearbooks the school can expect to sell.

Every school runs the risk of either losing money or disappointing students when it makes the toughest decision: how many yearbooks should be ordered. If the school orders too few then many students who want a yearbook will not be able to buy one. If the school orders too many then it could lose a lot of money paying for unsold books.

How can a school become successful at the business of selling yearbooks? A successful business has income (revenue) that meets or exceeds its expenses (cost). Expenses include fixed costs and variable costs. The fixed cost is money you spend regardless of the number of yearbooks you order. Included in fixed costs are office supplies, software licenses, training expenses and production costs (typesetting). The variable cost is the additional amount attached to each yearbook that is produced.

Revenue comes primarily from three sources: fundraising and donations, subsidies from the school or ASB budget, and the sale of the yearbooks. The price of the yearbook, a critical decision, will directly affect the sales. Price and quantity determine the revenue from sales. Price and quantity are usually an inverse relationship. As the price goes up the number of books you will sell decreases.

The algebra of tables, graphs and equations may be used as a tool to make the best decision.

# Centennial Legacy

The Centennial High School yearbook, *The Legacy*, will have \$14,000 in fixed costs this year. The variable cost is \$11.00 per yearbook. The yearbook advisor decides the yearbook will sell for \$60.00 and expects to sell 350 yearbooks at that price. There are 1,300 students attending Centennial HS.

- 1) Make a list of questions that are important to answer. Identify the questions that may involve the use of algebra to find the answer.
- 2) Prepare a table of sample total costs. Label the left-column, "Number of Yearbooks." Label the right column, "Total Cost."
- 3) Let "n" represent the number of yearbooks ordered and "c(n)" represent the total cost for "n" yearbooks. Write a function to represent the relationship between "n" and "c(n)."
- 4) Use the table of sample values to prepare a graph.
- 5) Use the context to discuss the meaning of slope, intercepts, domain, range, discrete and continuous. Discuss how changes in the context will affect the graph and the equation (and vice-versa). Discuss the questions you can answer using the graph and/or the equation.
- 6) Add a third column to your table. Label the third column, "Total Revenue."

- 7) Let " $r(n)$ " represent the total revenue from the sale of " $n$ " yearbooks and write a function to represent the relationship between " $n$ " and " $r(n)$ ."
- 8) Add the graph of Total Revenue to the graph of Total Cost.
- 9) Discuss the meaning of the point of intersection of the two lines. Discuss the questions you can answer using the functions or the graph.
- 10) What equation would you solve to determine the "break even" number?
- 11) Add a fourth column to your table. Label the fourth column, "Total Profit." Profit is the difference between your total revenue and your total cost. For each " $n$ " in your table, subtract the value in the second column (Total Cost) from the value in the third column (Total Revenue).
- 12) Let " $p(n)$ " represent total profit and write a function to represent the relationship between " $n$ " and " $p(n)$ ."
- 13) What changes will you need to make to the graph of Total Cost and Total Revenue in order to add the values for Total Profit? Go ahead and add the graph of  $p(n)$  to the graph with  $c(n)$  and  $r(n)$ .
- 14) Discuss the domain and range for the profit function. Discuss the meaning of the slope and both intercepts for the profit function.
- 15) Using the function " $p(n)$ ," what equation would you solve to determine the break even number?
- 16) What algebra vocabulary have you addressed using the context of yearbook sales? What algebra skills and concepts have you introduced and explored? What California Mathematics Content Standards have been incorporated?

## *Pi Dyed*

The Math Club will sell silk-screened t-shirts to raise money so members can attend a week-long math competition during the summer. The one-time cost for the artwork to be screened on the t-shirt is \$125. The cost per t-shirt is \$2.50. The Math Club expects to sell each t-shirt for \$6.00.

- 1) What function represents the total cost?
- 2) What function represents the total revenue?
- 3) What equation do you solve to determine the break even quantity?
- 4) The Math Club wants to raise \$5,000. How many t-shirts do they need to sell? What equation do you solve?
- 5) Prepare a table and graph the total cost, total revenue and profit functions.
- 6) Describe the change in the total cost graph if the artwork fee is raised to \$200.
- 7) Describe the change in the graph of total cost if the cost per t-shirt is raised to \$3.00.
- 8) Describe the domain and the range for the profit function.

# Algebra and Life Contexts

## **Compare Phone Rate Plans:**

[http://www.myrateplan.com/wireless\\_plans/filter.php](http://www.myrateplan.com/wireless_plans/filter.php)

## **Van's Skate Park**

[http://www.simon.com/mall/tenant\\_details.aspx?ID=1236&TID=60574](http://www.simon.com/mall/tenant_details.aspx?ID=1236&TID=60574)

## **Fitness Club**

<http://www.costhelper.com/cost/fitness/fitness-club.html>

## **McDonald's Kid Party**

[http://www.groupii.com/mcparty/macparty/loc\\_instoreparty.asp?ID=macparty](http://www.groupii.com/mcparty/macparty/loc_instoreparty.asp?ID=macparty)

## **Snow Cones**

<http://www.1-800-shaved-ice.com/shiceandsnco3.html>

<http://www.1-800-shaved-ice.com/snow-cone-cups.html>

<http://www.1-800-shaved-ice.com/shaved-ice-syrup.html>

<http://prairiemoon.biz/shavicesnowc4.html>

## **24-Hour Fitness**

<http://www.24hourfitness.com/membership/offers/specials.html>

## **Postal Rates**

<http://www.usps.com/prices/first-class-mail-prices.htm>

## **ADT Security System**

[http://www.safe24hrs.com/info.php?ref=1&cid=0539&gclid=CKWX1cjt\\_5MCFSQtagodHEIJWw](http://www.safe24hrs.com/info.php?ref=1&cid=0539&gclid=CKWX1cjt_5MCFSQtagodHEIJWw)

## **Lane County Fair**

<http://www.atthefair.com/carnival.cfm>

## **T Shirts**

<http://www.jonestshirts.com/product/5280>

<http://www.broken-arrow.com/approval.htm>

[http://www.screenprintedwear.com/design\\_samples.html](http://www.screenprintedwear.com/design_samples.html)

# Flip the Order

## Context → Skill

Algebra Skill/Vocabulary	Possible Real-Life Contexts
Evaluate expressions	
Solve two-step equations	
Distributive property	
Slope and Intercept	
System of Linear Equations	
Combine like terms	
Subtraction of Integers	

Two points to linear function	
Standard Form $Ax + By = C$	
Graphing linear inequalities	
Solving quadratic equations	
Factoring trinomials	
Square roots	
Exponential functions	
Rational functions	